



STATE OF RHODE ISLAND
**ENERGY EFFICIENCY &
RESOURCE MANAGEMENT COUNCIL**

CONSULTANT TEAM

national**grid**

Evaluation, Measurement and Verification (EM&V) & Other BC Model Updates

Presented to the EERMC By:
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Date: August 19, 2021



Outline

EM&V Process Overview

EM&V Studies Impacting BC Model

Other BC Model Impacts



Rhode Island EM&V Standards

This **Measurement and Verification (M&V) Plan** shall address:

- Savings verification, including where appropriate analysis of customer usage
- Verification should also facilitate participation in ISO-NE's forward capacity market
- Issues of ongoing program design and effectiveness
- Efforts related to market assessment and methodologies to claim savings from market effects, among others
- Regional and other cooperative EM&V efforts the distribution company is participating in, or plans to participate in
- Longer-term studies, as appropriate, to assess programs over time

Source: [Least Cost Procurement Standards](#)



EM&V Team

Rhode Island Evaluation Team



Oversight Team

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Plus other subject matter experts from each team as needed

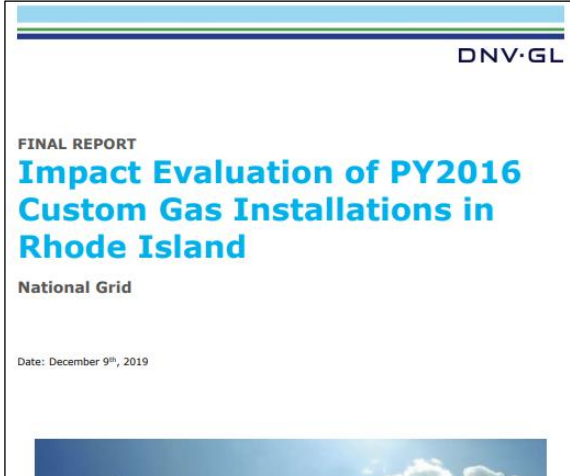


EM&V Oversight

RI Evaluation Team meets twice per month to review the status and updates associated with all identified EM&V studies

Sector	Programs	Study names	Fuel(s)	Type	State	Status (In-progress or Complete)	Will be completed in time for 2021 Plan? (Y/N/TBD)	Adopting Impact Factor in 3YP?	Adopting Results in 3YP?	Monthly Update	Call	NGRID Comments	Clean Comments
Residential Program Studies													
Res	Multiple	Ri-19-RE-HEM - Residential Home Energy Monitoring (Sense) Demonstration	Elec	Impact/Process	RI	In-progress	N	N	N	Y	Res	7/21: Revising non-participant survey guide	
Res	EWSF	Ri-20-RX-EWSF Impact - Impact Evaluation of EnergyWise Single Family Program	Elec/Gas	Impact	RI	In-progress	Y	Y	Y	Y	Res	7/21: Draft results memo expected this week	
Res	EWSF	Ri-20-RX-EWSF Process - Process Evaluation of EnergyWise Single Family Program	Elec/Gas	Process	RI	In-progress	Y	N	N	Y	Res	7/21: Finalizing analysis and drafting report	
Res	EWMF	Ri-20-RX-EWMF Impact - Impact Evaluation of EnergyWise Multifamily Program	Elec/Gas	Impact	RI	In-progress	Y	Y	Y	Y	Res	7/21: Draft results memo expected this week	
Res	EWMF	Ri-20-RX-EWMF Process - Process Evaluation of EnergyWise Multifamily Program	Elec/Gas	Process	RI	In-progress	Y	N	N	Y	Res	7/21: Finalizing analysis and drafting report	
Res	IEMF	Ri-20-RX-IEMF Impact - Impact Evaluation of Income Eligible Multifamily Program	Elec/Gas	Impact	RI	In-progress	Y	Y	Y	Y	Res	7/21: Draft results memo expected this week	
Res	IEMF	Ri-20-RX-IEMF Process - Process Evaluation of Income Eligible Multifamily Program	Elec/Gas	Process	RI	In-progress	Y	N	N	Y	Res	7/21: Finalizing analysis and drafting report	
Res	Behavior	Ri-20-RX-HERI Impact - Impact Evaluation of the Home Energy Reports Program	Elec/Gas	Impact	RI	In-progress	Y	Y	Y	Y	Res	7/21: Draft report is out for review. Comments due Aug 3rd.	
Res	Res Lighting	Ri-20-RE-UpstLight - Residential Lighting Market Assessment - Shelf Stocking	Elec	Market	RI	In-progress	Y	N	Y	Y	Res	7/21: Revising report to address 2nd round of comments.	
Res	Res Lighting	Ri-20-RE-UpstLight - Residential Lighting Market Assessment - Sales Data Analysis	Elec	Market	RI	In-progress	Y	N	N	Y	Res	7/21: Analysis in progress	
Res	Res Lighting	Lighting Supplier Interviews	Elec	Process	MA	In-progress	Y	N	N	Y	Res	5/26: Draft report.	
Res	Res Lighting	MA19R15-E-2019 Residential Lighting On-sites	Elec	Market	MA	In-progress	Y	N	N	Y	Res	Analysis underway	Reporting
Res	Res Lighting	MA20R22-E-LtgSalesDataAnalysis	Elec	Market	MA	In-progress	Y	N	N	Y	Res	Regional study - Includes RI data (see Ri-20-RE-UpstLight - Residential Lighting Market Assessment - Sales Data Analysis)	
Res	Res Lighting	Lighting Turn In Study	Elec	Impact	MA	Completed	Y	N	N	N	Res	Final report	
Res	Res Lighting	Lighting Hours of Use Study	Elec	Impact	MA	Completed	Y	Y	Y	N	Res	Final report delivered 04/01	
Res	Res Lighting	MA19R09-E-DW LED Delta Watt Update	Elec	Impact	MA	Completed	Y	Y	Y	N	Res	Final report	
Res	Res Lighting	18-8 Market Scan	Elec	Market	MA	Completed	Y	N	N	N	Res	Draft report.	
Res	RNC	RNC MF Baseline	Elec/Gas	Impact	MA	Upcoming	N	N	N	TBD	Res		
Res	RNC	RNC Non-Program Model Review (MA19R19-B-RNCP)	Elec/Gas	Process	MA	In-progress	N	N	N	TBD	Res		
Res	RNC	RNC Energy Optimization Cost Study (MA20R23-RNCEOCOST)	Elec	Cost	MA	In-progress	N	N	N	TBD	Res		
Res	RNC	Renovations and Additions Market Characterization and Potential Savings Study (RLPNC 18-12)	Elec	Market	MA	Completed	Y	N	N	N	Res		
Res	RNC	RNC Passive House Design Assessment	Elec/Gas	Process	MA	Completed	Y	N	N	N	Res	Not transferable	
Res	HES	HES Realization Rate Assessment	Elec/Gas	Impact	MA	Completed	Y	N	N	N	Res	Final report 3/23	
Res	Multifamily	Multifamily M&HP Assessment Study	Elec	Impact/Process	MA	Upcoming	N	N	N	TBD	Res		
Res	HVAC	2019-20 Winter Thermostat Optimization (MA20R20-B-WTO)	Elec/Gas	Impact	MA	In-progress	N	N	N	TBD	Res		
Res	HVAC	2019 Residential Summer Thermostat	Elec	Impact	MA	Completed	Y	N	N	N	Res		
Res	HVAC	Winter Thermostat Optimization (MA19R03-B-WTO)	Elec	Impact	MA	Completed	Y	N	N	N	Res		
Res	HVAC	Energy Optimization Process and Impact Study (MA20R24-E-EOP)	Elec	Impact	MA	Upcoming	N	N	N	TBD	Res		
Res	HVAC	Programmable Tstat Impact	Elec	Impact	MA	Upcoming	N	N	N	TBD	Res		
Res	HVAC	ECM Pumps	Elec	Impact	MA	Upcoming	N	N	N	TBD	Res		
Res	HVAC	Residential Energy Optimization Model Update (including Heat Pump Online Calculator	Elec	Impact	MA	Completed	TBD	N	N	N	Res	Study is complete with exception of online calculator.	
Res	DR	Residential Wi-Fi Thermostat DR Evaluation (MA19R01-E-RESDRTSTAT)	Elec	Impact	MA	Completed	Y	Y	Y	N	Res	Study is complete	
Res	DR	2019/2020 Residential Energy Storage Demonstration (MA19R02-E-DRDS)	Elec	Impact	MA	In-progress	Y	Y	Y	N	Res		
Res	Multiple	RCD Virtual Assessment Study	Elec/Gas	Process	MA	Upcoming	N	N	N	N	Res		
Res	Multiple	Smart Thermostat Impact Study (RES 24)	Elec/Gas	Impact	MA	In-progress	N	N	N	Y	Res	Expected completion 12/20	Implemented in multiple stages
Res	Multiple	Baseline Study Phase 4 - Smart Tstat and Gas Metering Add-ons	Elec/Gas	Impact	MA	In-progress	TBD	TBD	TBD	Y	Res	Reporting	
Res	Multiple	MA19R17-B-TBM Comprehensive TRM Review	Elec/Gas	Impact	MA	In-progress	Y	Y	Y	N	Res	Reporting	Final draft report available
Res	Multiple	Non-Participant Research	Elec/Gas	Market	MA	Completed	Y	N	TBD	N	Res	Final Report delivered 2/27	
Commercial & Industrial Studies													
C&I	C&I Gas	Ri-19-CG-CustGas - Impact Evaluation of PY2017 Custom Gas Installations	Gas	Impact	RI	In-progress	Y	Y	Y	Y	C&I	8/4: One-page summary provided by DNV 7/31 for review	
C&I	C&I Gas	Ri-20-CG-CustGasP19 - Impact Evaluation of PY2018 Custom Gas Installations	Gas	Impact	RI	In-progress	Y	Y	Y	Y	C&I	8/4: Expect MBV to be completed for 6 of 8 sites for first draft. Will incorporate DRs for other two sites by applying results from 6 sites to missing factors from DR	
C&I	C&I Gas	Ri-20-CG-CustGasP19 - Impact Evaluation of PY2019 Custom Gas Installations	Gas	Impact	RI	In-progress	N	N	N	N	C&I	8/4: Final 2019 year end data for sample design sent to DNV-GL. DNV GL working on sample design for desk reviews. Metering to start in the fall w/colder weather	
C&I	C&I Elec	Ri-19-CE-CustElec - Impact Evaluation of PY2018 Custom Electric Installations	Elec	Impact	RI	In-progress	Y	Y	Y	Y	C&I	8/4: Finalizing DRs. Will use desk reviews of 2018 to inform 3YP and Annual Plan	
C&I	C&I Elec	Ri-20-CE-CustElecP19 - Impact Evaluation of PY2019 Custom Electric Installations	Elec	Impact	RI	In-progress	N	N	N	N	C&I	8/4: Sample design complete. Unclear on when metering will start - will 2018 come first?	
C&I	C&I	Ri-20-CX-FRSD - C&I Free-Ridership and Spillover Study	Elec/Gas	NTG	RI	In-progress	Y	N	N	Y	C&I	8/4: Survey in progress. Results due week of 9/7 with goal of informing 3YP and Annual Plan. Planning to call through 8/21. Initial scope included upstream lighting	
C&I	C&I Lighting	Ri-19-CE-UpstLight - Impact Evaluation of PY20x Upstream Lighting Program	Elec	Impact	RI	Upcoming	Y	Y	Y	Y	C&I	8/4: NTG added to scope, workplan and budget in progress; piggybacking with MA	
C&I	C&I	Ri-19-CX-Presc - Prescriptive Gas & Electric Measures	Elec/Gas	Impact	RI	SEP	TBD	TBD	TBD	Y	C&I	8/4: Waiting for MA to determine scope	
C&I	C&I Demo	Ri-20-CX-SEM - Strategic Energy Management Demonstration Evaluation	Elec/Gas	Impact/Process	RI	In-progress	Y	N	Y	Y	C&I	8/4: Draft report under review by NGRID	
C&I	C&I Demo	Ri-20-CG-SBHP Small Business Heat Pump Demonstration Evaluation	Elec	Impact/Process	RI	Upcoming	Y	Y	Y	Y	C&I	8/4: Approach to demo changed; eval not needed in 2020.	

From Study to Plans



Rhode Island Technical Reference Manual

For Estimating Savings from Energy Efficiency Measures

2020 Program Year

Process

Sector: C&I Fuel: Gas Program Type: Custom
 Measure Category: Custom Measure Type: Process Measure Sub Type: Year round

Program: Large C&I Retrofit

Measure Description

The Custom project track is offered for energy efficiency projects involving complex site-specific applications that require detailed engineering analysis and/or projects which do not qualify for incentives under any of the prescriptive rebate offering. Projects offered through the custom approach must pass a cost-effectiveness test based on project-specific costs and savings.

Energy Impact Factors

Measure	Measure life	ISR	SPF	RRe Gas	RRe Electric	RR sp	RR wp	CF sp	CF wp
Process	mult	1.00	1.00	0.85					

In Re: The Narragansett Electric Company
d/b/a National Grid
Annual Energy Efficiency Plan for 2020

Docket No. 4979

ANNUAL ENERGY EFFICIENCY PLAN FOR 2020

SETTLEMENT OF THE PARTIES

Table E-5
National Grid
Calculation of 2020 Program Year Cost-Effectiveness
All Dollar Values in (\$000)

	RI Test Benefit/Cost ¹	Total Benefit	Program Implementation Expenses ²	Customer Contribution	Shareholder Incentive	e/Lifetime kWh
Non-Income Eligible Residential						
Residential New Construction	2.65	\$ 4,712.9	\$ 973.5	\$ 807.8		11.2
ENERGY STAR® HVAC	2.64	\$ 12,522.0	\$ 2,783.2	\$ 1,965.1		25.3
EnergyWise	2.23	\$ 38,682.0	\$ 15,692.2	\$ 1,659.1		77.8
EnergyWise Multifamily	2.79	\$ 9,296.8	\$ 2,808.3	\$ -		11.4
Home Energy Reports	2.82	\$ 7,701.1	\$ 2,728.1	\$ -		11.7
ENERGY STAR® Lighting	6.05	\$ 62,401.2	\$ 15,375.8	\$ (5,069.1)		5.1
Residential Customer Products	2.97	\$ 9,982.9	\$ 2,199.2	\$ -		10.5
Residential ConnectedSolutions	3.68	\$ 1,697.1	\$ 461.6	\$ -		N/A
Energy Efficiency Education Programs		\$ -	\$ 40.0	\$ -		
Residential Pilots		\$ 297.8	\$ -	\$ -		
Community Based Initiatives - Residential		\$ 203.9	\$ -	\$ -		
Comprehensive Marketing - Residential		\$ 382.3	\$ -	\$ -		
Non-Income Eligible Residential SUBTOTAL	3.12	\$ 146,956.0	\$ 43,931.9	\$ 1,046.2	\$ 2,159.1	13.3
Income Eligible Residential						
Single Family - Income Eligible Services	2.78	\$ 35,667.4	\$ 12,846.1	\$ -		31.8
Income Eligible Multifamily	2.33	\$ 8,286.5	\$ 3,540.0	\$ -		11.1
Income Eligible Residential SUBTOTAL	2.55	\$ 43,953.9	\$ 16,386.1	\$ -	\$ 819.8	22.7
Commercial & Industrial						
Large Commercial New Construction	7.00	\$ 43,816.6	\$ 5,335.7	\$ 920.2		4.2
Large Commercial Retrofit	8.01	\$ 303,474.8	\$ 23,801.3	\$ 14,065.2		4.6
Small Business Direct Install	3.75	\$ 37,514.2	\$ 7,568.6	\$ 2,439.0		7.9
Commercial ConnectedSolutions	13.01	\$ 27,031.2	\$ 2,078.5	\$ -		N/A
Commercial Pilots		\$ 106.3	\$ -	\$ -		
Community Based Initiatives - C&I		\$ 66.1	\$ -	\$ -		
Finance Costs		\$ 5,216.7	\$ -	\$ -		
C&I SUBTOTAL	6.47	\$ 411,836.8	\$ 44,173.2	\$ 17,424.4	\$ 2,099.4	5.6
Regulatory						
ORR		\$ 893.7	\$ -	\$ -		
EERMC		\$ 893.7	\$ -	\$ -		
Regulatory SUBTOTAL		\$ 1,787.4	\$ -	\$ -	\$ -	
TOTAL	4.64	\$ 602,746.7	\$ 106,391.6	\$ 18,470.6	\$ 5,078.3	8.3

Notes:
 (1) RI Test B-C Test = (Energy + Capacity + Resource Benefits - Economic Benefits + Carbon Benefits) / (Program Implementation + Customer Contribution + Performance Incentive)
 Also includes effects of free-ridership and spillover.
 (2) For Implementation Expenses derivation, see Table E-3.
 (3) ENERGY STAR® Lighting customer cost is negative due to a high free-ridership rate. Any financial incentives paid to free-riders are counted as a cost because the Company incurred those costs as part of the overall cost of the Plan regardless of whether the participant is free-rider or not. Therefore the Company reduces benefits and the customer cost by the net-to-gross ratio but not the incentives.

Table 1-1. PY2016 National Grid territory results in MA and RI

Results by State	MA	RI	MA+RI
Tracking Savings (therms)	5,141,434	1,114,770	6,256,204
Evaluated Savings (therms)	4,534,668	795,000	5,329,668
Realization rate	88%	71%	85%
Relative Precision 80% CI	±9%	±11%	±8%
Error bound	8%	8%	7%
Sample size	21	8	29
Error ratio	0.35	0.27	0.34

BC Model

Benefits

Costs

2020 RI Gas BCR Model Final Draft

Sector	Program	Measure	Quantity	Measure Life	Total Resource Cost	Incentive	Customer Cost	Free-Ridership Rate	Spillover [Participant] Rate	Spillover [Non-Participant] Rate	Net to Gross	In-Service Rate	kWh Realization Rate
C - Commercial & Industrial	Large C&I Retrofit	Custom: General	72,200	13	32.2	16.1	\$ 16	11.1%	0%	0.0%	88.9%	100.0%	85.0%

Significant C&I Measure-Level Impacts

Significant Measure-Level Impacts (Study Number Shown in slides 13, 14 and 15)

- Lighting (10) – In-service rates updated as follows:
 - *Non screw-based measures **increased** from 76% to 95-98%.*
 - *Screw-based measures **decreased** from 76% to 49%*
- Lighting (11) – Measure lives decreased:
 - *Linear LEDs: **9 years to 7 years***
 - *Exterior LEDs: **7 years to 6 years***
 - *Screw-In LEDs: **4 years to 2 years***

Significant Residential Gas Measure-Level Impacts

Significant Measure-Level Impacts (Study Number Shown in slides 13, 14 and 15)

- Furnaces (1) – Lifetime gas savings reduction of around 40%
- Boilers (1) – Eliminated 90 AFUE measure and 95 AFUE gas lifetime savings reduction of around 31%
- Combo Boilers (1) – Eliminated 90 AFUE measure and 95 AFUE gas lifetime savings reduction of around 18%
- Storage Water Heater (1) – Gas lifetime savings reduction of around 27%
- Showerheads, thermostatic shutoff valve(TSVs) and Showerheads w/ TSVs (1)– measure life (ML) increased from 7 to 15 years
- Thermostats (2) – Savings decrease from 3.5 MMBTU to 2.07 MMBTU
- Indirect Water Heater (3) – Savings decrease from 8.0 MMBTU to 4.0 MMBTU
- Low Rise New Construction (4) – Net-to-gross (NTG) decrease from 100% to 75% (This update will be made in next version of BCR model)

Significant Residential Electric Measure level Impacts

Measure Update Impacts (Study Number Shown in slides 13, 14 and 15)

- Central AC (1) – Electric lifetime savings reduction of around 24%
- LEDs (5) – ML reduction from 2 years to 1 year for all direct install measures
- LEDs (5) – Energy Star lighting program will be discontinued
- ECM Pumps (6) – Annual energy savings reduction from 142 kWh to 75.2 kWh
- Dehumidifier Recycling (7) – NTG reduction from 58% to 41%



Other BC Model Impacts

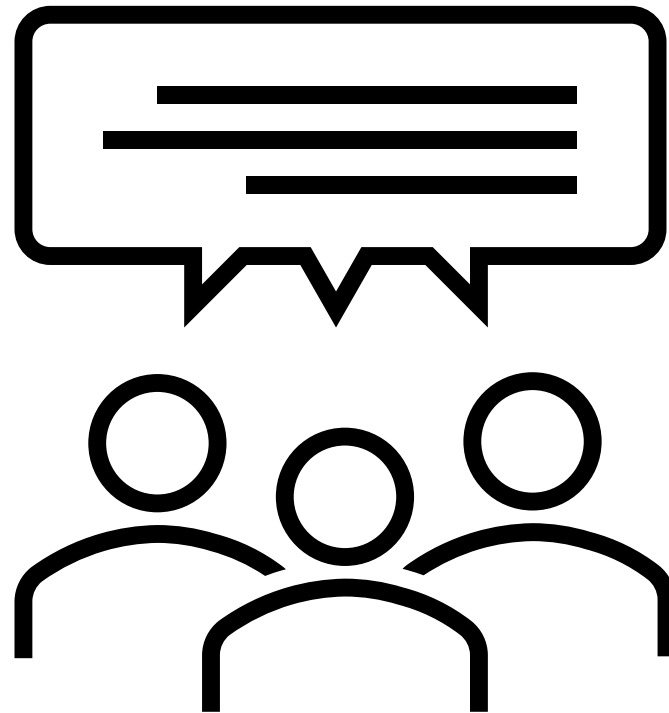
Applied the Avoided Energy Supply Components (AESC) 2021 Results

- Using Counterfactual #4 to screen the 2022 Annual Plan. This counterfactual models a future state without programmatic demand response or energy efficiency.
- Most categories of avoided costs declined from AESC 2018 to AESC 2021 due to a variety of factors. Some categories, notably the non-embedded GHG cost, increased.
- Refer to Executive Summary Table 4 (page 7) for a summary of changes from AESC 2018 to AESC 2021: https://www.synapse-energy.com/sites/default/files/AESC%202021_20-068.pdf

Removal of economic development impacts from core BCR reporting also notable



Council Member Discussion





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APPENDIX

Summary of Studies Informing 2022 Benefit-Cost Model

1. MA TRM Study – Reviewed MA TRM to determine if residential baseline study could be used to update any impact factors. Changes mostly revolved around (ML) and baseline – Industry standard practice (ISP) updates ([MA19R17-B-TRM Final Report 2021-04-12 clean.pdf](#))
2. MA Wi-Fi Thermostat – Study updated deemed gross savings values for programmable and Wi-Fi thermostats. (Report has not been finalized yet)
3. MA Home Energy Services Impact Evaluation – For 2022 plan, study updated gross savings for indirect water heater and boiler reset controls ([RES34 HES-Impact-Evaluation-Report-with-ES FINAL 29AUG2018.pdf \(ma-eeac.org\)](#))
4. Residential New Construction Common Assumption – Assumption based on declining NTG results seen in recent NTG studies in both MA and CT (No formal report)
5. LED Common Assumption – As LED lighting is ramping down and becoming more challenging to estimate the ML, ML were estimated via discussions with stakeholders. (No formal report)
6. MA ECM Pump Study – Completed an engineering review to update energy savings for ECM Pumps. (Report is in draft form at this time)

Summary of Studies Informing 2022 Benefit-Cost Model

7. MA Residential Appliance Recycling Net Saving Update – Updated the current RR and NTG for the residential recycling measures. ([MA-20X03-E-Appliance-Recycling-NTGReport FINAL 2021.07.23-clean.pdf](#))
8. MA Residential Products NTG – Updated current NTG and ISR values for the residential products program (Report is in draft form at this time)
9. MA VHEA – Updated the ISR for both direct install measures and mail in measures. Plan has weighted average assuming 30% of audits would be virtual audits in 2022. ([MA20R26-B-VHEA Report FINAL 12MAR2021.pdf \(ma-eeac.org\)](#))
10. RI Impact Evaluation of Upstream Lighting – Updated Realization Rates through an update to In-Service Rate (ISR).
11. MA Market Model – Updated lighting measure lives.
12. MA C&I HVAC & Water Heater NTG & Market Effects Measurement – Establish Net to Gross Ratios (NTGRs) for six technologies supported by the Upstream HVAC and Water Heater Initiative.

Summary of Studies Informing 2022 Benefit-Cost Model

13. Rhode Island Commercial and Industrial Impact Evaluation of PY2018 and PY2019 Custom Electric Installations – Verified savings estimates for a sample of custom electric projects through site-specific inspection, metering, and analysis.
14. Rhode Island Commercial and Industrial Impact Evaluation of PY2019 Custom Gas Installations – Verified savings estimates for a sample of custom gas projects through site-specific inspection, metering, and analysis.

Studies Informing 2022 Benefit-Cost Model: C&I

Program	Study Type	About
C&I Custom Gas	Impact	<p>Verify savings estimates for a sample of custom gas projects through site-specific inspection, metering, and analysis.</p> <p><i>Plan impact: Increase in claimable savings. Realization rate increases from 84.2% to 86.7%.</i></p>
C&I Custom Electric	Impact	<p>Verify savings estimates for a sample of custom electric projects through site-specific inspection, metering, and analysis.</p> <p><i>Plan impact: Increase in claimable savings. Realization rate increases from 93.8% to 95.2% for lighting and from 71.9% to 78.9% for non-lighting.</i></p>
C&I Upstream HVAC and Water Heating	Market	<p>Determine net-to-gross ratio for six upstream program technologies.</p> <ul style="list-style-type: none"> Volume water heater: 44% Instantaneous water heater: 38% VRF: 30% Package (AC, HP): 55% Storage water heater: 29% Indirect water heater: 36% <p><i>Plan impact: Net decrease in claimable electric and gas savings</i></p>

Studies Informing 2022 Benefit-Cost Model: C&I

Program	Study Type	About
Lighting	Impact	<p>RI Impact Evaluation of Upstream Lighting. This Study updated Realization Rates through an update to In-Service Rate (ISR).</p> <p><i>Plan Impact:</i> <i>ISRs for non Screw-based measures increased from 76% to 95-98%</i> <i>ISRs for Screw-based measures decreased from 76% to 49%</i></p>
	Market	<p>Market Model (MA). This study updated measure lives.</p> <p><i>Plan Impact: Changes as follows:</i> <i>Linear LEDs: 9 years to 7 years</i> <i>Exterior LEDs: 7 years to 6 years</i> <i>Screw-In LEDs: 4 years to 2 years</i></p>

Studies Informing 2022 Benefit-Cost Model: Res

Study/Program	Study Type	About
<p>Gas Energy Star Heating System</p>	<p>Impact</p>	<p>MA TRM Review study reviewed and determined if any impacts can be updated with new information gathered from the MA Residential Baseline Study (Load Shape Study), MA Wi-Fi Thermostat study updated savings for Wi-Fi and programmable thermostat, MA Navigant HES Impact Evaluation study updated savings for boiler reset controls and indirect water heaters</p> <p><i>Plan impacts: Resulted in a significant decline in gas savings</i></p> <p><i>Gas Heating Equipment – Baseline Changes – Significant Increase in Industry Standard Practice (ISP) and reduction in Measure life (ML)</i></p> <ul style="list-style-type: none"> - <i>Furnaces – Lifetime gas savings decrease of around 40%</i> - <i>Boilers – Eliminated 90 AFUE measure and 95 AFUE gas lifetime savings decrease of around 31%</i> <p><i>Water Heating - Baseline Changes – Small Increase in ISP and reduction in Storage WH ML</i></p> <ul style="list-style-type: none"> - <i>Storage Water Heater – Gas lifetime savings decrease of around 27%</i> - <i>Tankless Water Heater – Gas lifetime savings decrease of around 4%</i>

Studies Informing 2022 Benefit-Cost Model: Res

Study	Type	About
<p>Gas Energy Star Heating System (Continued)</p>	<p>Impact</p>	<p><i>Gas Combo – Baseline Changes – Increase in ISP for both water heating and heating</i></p> <ul style="list-style-type: none"> - <i>Combo Boilers – Eliminated 90 AFUE measure and 95 AFUE gas lifetime savings decrease of around 18%</i> - <i>Showerheads, TSVs and Showerheads w/ TSVs – ML increased from 7 to 15 years</i> - <i>Wi-Fi thermostats – Savings decreased from 3.11 MMBTU to 2.79 MMBTU</i> - <i>Thermostats – Savings decreased from 3.5 MMBTU to 2.07 MMBTU</i> - <i>Boiler Reset Control – Savings increased from 4.5 MMBTU to 5.1 MMBTU</i> - <i>Indirect Water Heater – Savings decreased from 8.0 MMBTU to 4.0 MMBTU</i>
<p>Electric Energy Star HVAC</p>	<p>Impact</p>	<p>Same MA TRM Review Study from above. ECM Pump Study completed an engineering review to update energy savings for ECM Pumps.</p> <p><i>Plan impacts: Decrease in claimable electric savings</i></p> <ul style="list-style-type: none"> - <i>Central AC – Baseline Change – Increase to ISP – Electric lifetime savings decrease of around 24%</i> - <i>ECM Pumps - Annual energy savings decreased from 142 kWh to 75.2 kWh</i>

Studies Informing 2022 Benefit-Cost Model: Res

Program	Study Type	About
EnergyWise Single Family	Impact	<p>MA Wi-Fi thermostat Study updated savings assumptions for programmable and Wi-Fi thermostats. Common Assumption - As LED lighting is ramping down and becoming more challenging to estimate the ML, ML were estimated via discussions with stakeholders. MA VHEA Study updated the ISR for both direct install measures and mail in measures. Plan has weighted average assuming 30% of audits would be virtual audits in 2022.</p> <p><i>Plan impact: Decrease in claimable savings for electric and gas</i></p> <ul style="list-style-type: none"> - <i>For programmable thermostats, gas savings decreased from 3.2 MMBTU to 2.07 MMBTU</i> - <i>For Wi-Fi thermostats, gas savings decreased from 3.2 MMBTU to 2.79 MMBTU</i> - <i>For LEDs, EUL decreased from 2 years to 1 year</i> - <i>For LED bulbs there is a 100% ISR for direct install and 83% ISR for mailed measures.</i> - <i>For Showerheads there is a 98% ISR for direct install and 53% ISR for mailed measures.</i> - <i>For faucet aerators there is a 98% ISR for direct install and 59% ISR for mailed measures.</i> - <i>For LED bulbs there is a 100% ISR for direct install and 59% ISR for mailed measures.</i>

Studies Informing 2022 Benefit-Cost Model: Res

Study	Type	About
Income Eligible Single Family	Impact	<p>MA Wi-Fi thermostat Study updated savings assumptions for programmable and Wi-Fi thermostats. Common Assumption - As LED lighting is ramping down and becoming more challenging to estimate the ML, ML were estimated via discussions with stakeholders.</p> <p>Plan impact: Decrease in claimable savings for electric and gas</p> <ul style="list-style-type: none"> - <i>For programmable thermostats, gas savings decreased from 3.38 MMBTU to 2.07 MMBTU</i> - <i>For LEDs, ML decreased from 2 years to 1 year</i>
EnergyWise Multi Family & Income Eligible Multi Family		<p>MA TRM Review study reviewed and determined if any impacts can be updated with new information gathered from the MA Residential Baseline Study (Load Shape Study), Common Assumption - As LED lighting is ramping down and becoming more challenging to estimate the ML, ML were estimated via discussions with stakeholders.</p> <p>Plan impact: Decrease in claimable savings for electric and gas</p> <ul style="list-style-type: none"> - <i>For programmable thermostats, ML decreased from 19 years to 13 years</i> - <i>For LEDs, ML decreased from 2 years to 1 year</i> - <i>Showerheads, TSVs and Showerheads w/ TSVs – ML increased from 7 to 15 years</i>

Studies Informing 2022 Benefit-Cost Model: Res

Program	Study Type	About
Energy Star Products	NTG	<p>MA Residential Products NTG study updated current NTG and ISR values for the residential products program, RI Residential Recycling Memo updated the current RR and NTG for the residential recycling measures</p> <p><i>Plan impact: Small decrease to Overall Program level savings</i></p> <ul style="list-style-type: none"> - Room Air Conditioner – NTG decreased from 63% to 56% - Dehumidifier – NTG decreased from 58% to 49% - ISR increased from 96% to 99% - Energy Star Dryer – NTG decreased from 54% to 53% - ISR increased from 97% to 99% - Pool Pump – NTG decreased from 93% to 89% - Room Air Cleaner – NTG decreased from 68% to 63% - Dehumidifier Recycling – NTG decreased from 58% to 41% - Freezer Recycling – NTG decreased from 56% to 50% and RR increased from 68% to 83% - Refrigerator Recycling – NTG increased from 44% to 46% and RR increased from 88% to 90%

Studies Informing 2022 Benefit-Cost Model: Res

Program	Study Type	About
Residential New Construction	NTG	<p>MA TRM Review study reviewed and determined if any impacts can be updated with new information gathered from the MA Residential Baseline Study (Load Shape Study), Common Assumption - As LED lighting is ramping down and becoming more challenging to estimate the ML, ML were estimated via discussions with stakeholders. Common Assumption – NTG value – Based on declining NTG trend seen in CT and MA</p> <p><i>Plan impact: Decrease to electric savings and increase in gas savings</i></p> <ul style="list-style-type: none"> - <i>For LEDs, ML decreased from 2 years to 1 year</i> - <i>For Showerheads, ML increased from 7 to 15 years</i> - <i>Low Rise NTG decreased from 100% to 75%</i> - <i>Renovation and Addition NTG decreased from 100% to 92%</i>